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WAFER HANDLING CHECKER

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The invention relates to a wafer handling checker for checking an operation state of a semiconductor wafer.

2. Description of Related Art:

An operation for training with wafers in the fabrication of semiconductor devices generally has been conventionally performed by having an operator to be trained (herein referred to as a trainee) transfer genuine wafers housed in each slot of a cassette and inspecting the surfaces of the transferred wafers, thereby checking on any increase in the number of defects, such as a flaw and the like, to measure the degree of advancement of the training operation.

However, according to the conventional method of training with wafers, it was necessary to determine the number of defects of the wafers before the training operation with the wafers, and again determine the number of defects of the wafers after the training operation with the wafers, thereby checking the increase in the number of defects which occurred during the training operation with the wafers. Accordingly, there were problems in that not only an enormous quantity of work and time were required for inspecting the wafers, but also material cost increased because it was difficult to recycle the wafers which suffered a great amount of damage, and hence, such damaged wafers had to be disposed of.

SUMMARY OF THE INVENTION

To solve the problems of the prior art, a wafer handling checker of the invention comprises a plurality of operation training wafers, for example, to which a conductive film is applied on the face thereof, a cassette having a plurality of slots in which the plurality of wafers are housed, and a plurality of electrodes which contact the plurality of wafers when the plurality of wafers are inserted into the plurality of slots, a pincette having a conductive suction part for operating on the plurality of wafers, voltage application means for applying a voltage between the respective electrodes of the cassette and the suction part of

the pincette, and state detection means for detecting contact between the pincette and each wafer by detecting potentials of the respective electrodes of the cassette or a current flowing to the electrodes.

Since the wafer handling checker is structured as set forth above according to the invention, the training operation with the wafers can be performed in the following manner.

The plurality of operation training wafers are inserted into the slots of the cassette for housing the wafers. As a result, respective wafers contact respective electrodes provided in respective slots. When a trainee who performs an operation on the wafer contacts the suction part of the pincette to the wafer housed in the cassette, a current flows between the corresponding electrode and the suction part via the contacted wafer owing to a voltage applied from the voltage application means. A potential of each electrode or a current flowing to each electrode is detected by the state detection means, thereby detecting the state of contact between the pincette and the wafer.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a view showing a conceptual diagram of a wafer handling checker according to an embodiment of the invention; and

Fig. 2 is a schematic view showing a configuration of the wafer handling checker in Fig. 1.

PREFERRED EMBODIMENT OF THE INVENTION

Fig. 1 is a view showing a conceptual diagram of a wafer handling checker according to an embodiment of the invention.

The wafer handling checker comprises a cassette 10 made of an insulating material for transporting wafers and in which a plurality of wafers 1a, 1b,..., 1n are housed, a vacuum pincette 20 for taking out the wafers 1a to 1n, one by one, from the cassette 10 to transfer the taken out wafer, a control box 30, and a computer 40. The wafers 1a to 1n are exclusively used for the training operation with the wafers and they are formed of a semiconductor wafer to which a conductive film, such as gold, is applied on the entire face thereof.

Slots 11a, 11b,..., 11n are provided in the cassette 10 by partitioning the

cassette 10 for housing the wafers 1a to 1n therein. Display means 12a, 12b,..., 12n (e.g., light emitting diodes (hereinafter referred to as LEDs)) are attached to an upper portion of the cassette 10 corresponding to the slots 11a, 11b,..., 11n for specifying the wafer to be operated on. Electrodes 13a, 13b,..., 13n are provided on bottom portions of the slots 11a to 11n so as to contact the wafers inserted into these slots 11a to 11n, thereby individually pulling up the potential of respective wafers to a power supply potential (level "H").

The vacuum pincette 20 comprises a suction part 21 having an opening, a handle grip 22 and a vacuum pump, not shown. An opening of the suction part 21 contacts the wafer 1 and the opening is brought into a vacuum state by the suction from the vacuum pump, thereby suctioning the wafer 1. The handle grip 22 is a part to be gripped by an operator when performing an operation on the wafer, and a switch 23 is provided on the handle grip 22 for operating the vacuum state of the suction part 21. A conductive film, such as gold, is applied to the surface of the suction part 21 and it is connected to a grounding potential (level "L") via a signal line 31a from the control box 30.

The control box 30 controls a signal control between the cassette 10, the vacuum pincette 20 and the computer 40, and it is connected to the vacuum pincette 20 via the signal line 31a, to the cassette 10 via a signal line 31b, and to the computer 40 via an interface cable 32. A switch 33 and a buzzer 34 are provided in the control box 30, and a control circuit for controlling the cassette 10 and monitoring the state of the cassette 10 and the like is housed in the control box 30.

The switch 33 is pushed by the trainee when the trainee performing an operation on the wafers receives a next operation specification after the transferring operation of the specified wafer is completed. The buzzer 34 informs the trainee of an erroneous operation by sounding when the trainee erroneously selects another wafer or makes the specified wafer contact the other wafers when performing a wafer transferring operation.

The computer 40 specifies to the control box 30 the sequence of the operation training or stores the result of training.

Fig. 2 is a schematic view showing a configuration of the wafer handling checker in Fig. 1.

The wafer handling checker has an LED driving part 35 for driving the LEDs 12a to 12n of the slots 11a to 11n of the cassette 10. The wafer handling checker further includes voltage application means (e.g., pull-up resistors) 36a, 36b,..., 36n for pulling up the electrodes 13a to 13n to a power supply potential (level "H"), waveform shaping parts 37, 37b,..., 37n for shaping signal waveforms of the electrodes 13a to 13n, and state detection means (e.g., state detection part) 38.

The pull-up resistors 36a to 36n apply a potential "H" to the wafers inserted into the slots 11a to 11n via the electrodes 13a to 13n and allow only the wafer which is in contact with the vacuum pincette 20 to be in the potential "L", thereby detecting the state of the wafer. The waveform shaping parts 37a to 37n remove improper signals, such as chattering and the like, which are generated when the vacuum pincette 20 contacts the wafers and output a signal for effecting correct state detection. The state detection part 38 is connected to output sides of the waveform shaping parts 37, 37b,..., 37n.

Both the LED driving part 35 and the state detection part 38 are connected to decision means (e.g., control and decision part) 39, and the switch 33 and the output means (e.g., buzzer) 34 are connected to the control and decision part 39. Further, the control and decision part 39 is connected to the computer 40 which operates as an operation specification part 41 and a storage part 42. The LED driving part 35, the state detection part 38 and the control and decision part 39 are respectively housed in the control box 30, as shown in Fig. 1, together with the pull-up resistors 36a to 36n and the waveform shaping parts 37a, 37b,..., 37n.

An operation of the wafer handling checker is described next.

The wafers 1a to 1m for the training operation are inserted into all the slots 11a to 11m of the cassette 10, except a given slot (e.g., the slot 11n), in preparation of performing the training operation with the wafer. Further, the control box 30, the computer 40 and the vacuum pincette 20 are respectively activated.

Then, the trainee pushes the switch 33 of the control box 30. The control and decision part 39 reads out operation specification information for specifying a slot (e.g., the slot 11b) in which the wafer to be transferred is to be inserted by the

operation specification part 41 in response to a signal from the switch 33. Further, the control and decision part 39 supplies a driving signal for lighting up the LED 12b corresponding to the wafer 1b to be operated to the LED driving part 35. The LED driving part 35 lights up the LED 12b in response to the driving signal.

The trainee suctions the wafer 1b specified by the LED 12b with the vacuum pincette 20 and removes the suctioned wafer 1b from the slot 11b to transfer it to the vacant slot 11n. The state of transferring of the wafers at this time is monitored, one by one, by the state detection part 38 based on the potentials of the electrodes 13a to 13n.

That is, when the suction part 21 of the vacuum pincette 20 contacts the specified wafer 1b, since the suction part 21 is connected to the grounding potential, the electrode 13b provided on the slot 11b of the cassette 10 is changed to "L" via the conductive wafer 1b. At this time, the other electrodes 13 remain "H" since they are connected to the power supply potential via the pull-up resistors 36. As a result, the state detection part 38 can detect that the vacuum pincette 20 contacts the specified wafer 1b.

Then, when the wafer 1b is taken out from the slot 11b, the electrode 13b is moved away from the slot 11b and its potential returns to "H" by the pull-up resistor 36b, and hence, the state detection part 38 can detect that the wafer has been removed from the slot 11b.

Further, when the wafer 1b taken out from the slot 11b is inserted into the vacant slot 11n, the electrode 13n provided in the slot 11n is rendered "L" via the conductive wafer and the suction part 21 of the vacuum pincette 20. Accordingly, the state detection part 38 can detect that the wafer 1b is transferred from the slot 11b to the slot 11n.

During the transfer of the wafer 1b, if the suction part 21 contacts a wafer, e.g., the wafer 1i, other than the specified wafer 1b, or the transferring wafer 1b contacts the other wafer 1i, the electrode 13i corresponding to the contacted wafer 1i is rendered "L". The states of the electrodes 13a to 13n are supplied from the state detection part 38 to the control and decision part 39 as operation state information.

The control and decision part 39 compares the operation specification

information read out from the operation specification part 41 with the operation state information detected by the state detection part 38, and determines whether an erroneous operation has occurred. When the control and decision part 39 decides that an erroneous operation has occurred, it immediately actuates the buzzer 34 so as to sound, thereby calling the trainee's attention.

Upon completion of the transfer of the specified wafer, the trainee pushes the switch 33 of the control box 30. As a result, the control and decision part 39 reads out the operation specification information for specifying the next wafer to be transferred from the operation specification part 41, and the same operations are repeated.

In such a manner, upon completion of a series of training operations with the wafers, information representing the result of the training, such as the presence or absence and the number of occurrences of erroneous operation, operating time and the like is outputted to the storage part 42 and stored therein.

As set forth above, since the wafer handling checker according to the embodiment of the invention employs the wafers 1 for the training operation to which a conductive film is deposited on the entire face thereof and the vacuum pincette 20 having the conductive suction part 21, there is an advantage in that the training operation state can be checked within a short period of time with assurance. Further, since the wafers 1 for the training operation can be repetitively used, there is an advantage that the cost can be reduced.

The invention is not limited to the foregoing preferred embodiment and can have various modifications. Examples of modifications include the following.

(a) Although each wafer 1 employs a semiconductor wafer to which a conductive film is applied on the entire face thereof, the wafers 1 may be formed of ceramics to which a conductive film is applied, or may be a material having conductive properties with the same shape as the wafer formed of the semiconductor wafer.

(b) Although the operation state can be detected in response to the change of potential level of the wafer using the vacuum pincette 20 connected to the grounding potential while the wafer 1 is pulled up to "H", a vacuum pincette connected to the power supply potential may be used while the wafer 1 is pulled down to "L". Further, a current flowing between the wafer and the vacuum

pincette may be detected.

(c) Although the exclusive control box 30 and the general-purpose computer 40 are combined to structure respective processing parts, such as the LED driving part 35, the waveform shaping part 37, the state detection part 38, the control and decision part 39, the operation specification part 41, the storage part 42 and the like, the method of structuring the overall wafer handling checker is optional. That is, these constituents may be integrated with one another as an exclusive controller or the entire structure may be controlled by software of the general-purpose computer while the control box 30 merely serves as an input/output part.

(d)Input/output equipment such as a keyboard, a speaker and the like may be employed instead of the switch 33 and the buzzer 34.

(e) Although the embodiment is explained in the case where the wafer handling checker is used for performing the training operation with the wafers by the trainee, in a case where the wafers are transported using a robot, the vacuum pincette 20 is replaced by a robot arm, so that the transportation state of the wafers can be checked up by the robot.

(f) The robot which is accurately adjusted in the above item (e) can be used for detecting the deformation of the cassette 10.

As mentioned in detailed above, according to the first and second aspects of the invention, there are provided the cassette for housing the conductive operation training wafers, and having electrodes for applying the voltage to the wafers, and the state detection means for detecting that the conductive suction part of the pincette contacts each wafer housed in the cassette. As a result, the handing state of the wafers can be easily and quickly known.

According to the third aspect of the invention, there is provided decision means for deciding the presence or absence of erroneous operation in response to a result of detection by the state detection means and the operation specification information. As a result, it is possible to determine the degree of advancement of the wafer training operation, in addition to the effect of the first aspect of the invention.

According to the fourth aspect of the invention, there is provided output means for generating sound when the decision means decides the presence of

erroneous operation. As a result, the trainee of operation training can know the erroneous operation at that moment, thereby enhancing the learning effect.